Evaluation of user interactions with clinical information systems using cognitive and ethnographic methods

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INTRODUCTION

User acceptance of the computer-based patient record (CPR) depends, among other things, upon the quality of the human-computer interface and its smooth integration into the clinical work flow (1,2). In this study, we have attempted to combine ethnographic and cognitive methods in order to evaluate the performance of two different user interfaces to a CPR system.

METHODS

The method we propose comprises the following steps: 1) observation and video recording of clinical cases involving the paper-based record, 2) reconstruction of the structure and content of the paper-based record, 3) reconstruction of the clinician's chronological pathway through the record, 4) proposition analysis of the transcribed verbal protocols in order to define the semantic structure of the solutions to clinical problems. This allows for the distinction of the respective contributions of the "professional" problem-solving strategies and of the "clerical" record manipulation strategies to the performance of the interaction. Components of the clerical domain related to the paper-based record are then replaced with simulated components from the two versions of the CPR and record manipulation activities using the CPR can thus be reconstructed (step 5). Interaction performance measures are derived from the reconstructed record manipulation activities (step 6). In this study, we have focused on the use of the system in "consultation mode", i.e. excluding data entry activities. Three cases are used to illustrate our approach, two involving an internist, and the third one a nurse.

RESULTS

Certain features of the interaction are readily apparent from the graphic representation of the chronological pathway through the paper-based record. Manipulation of the record is split in two distinct phases. First, the whole record is traversed in reverse chronological order in a selective fashion. The second phase of the manipulation is harder to interpret from its graphical representation alone.

Analysis of the verbal protocols reveals how the nodes of the solution model and their links are identified and reinforced during the course of the consultation. For example, in one of the cases, the entire solution is built in a monotonous way: there is no backtracking in the problem space (i.e. no retraction of hypotheses), which is characteristic of expert problem solving. Proposition analysis confirms that model construction proceeds in two phases, corresponding to the two distinct behavioral patterns described previously. The first phase of model construction is "data driven". During this phase, the model develops mostly under the influence of data obtained from the record. The model is developed initially by using most of the relevant information encountered at the beginning of the record. Once the model takes shape, subsequent information is more likely to be redundant and the "skimming" process becomes more and more selective. The second phase of the process is "model driven". At this point, the clinician is looking for specific pieces of information in order to complete her solution model.

CONCLUSIONS

The results suggest that constraints imposed by one of the user interfaces would probably not allow physicians to use the CPR even in "consultation" mode (i.e. without data entry) in clinical situations of average complexity. Indeed, the cognitive load generated by the record manipulation activities would very likely interfere with the cognitive processes involved in physicians' problem solving. Simulation parameters, which in general favor the CPR over the paper-based record, reinforce these conclusions. This may not be the same for nurses or other health professionals.

The second user interface seems to reduce significantly the performance constraints related to interface manipulation and interaction time. If the same amount of time were allocated for CPR and paper-based record interaction, the number of manipulations would become even more manageable. This could free enough cognitive resources for allowing adequate solution model construction during the interaction and favor user acceptance. This hypothesis should be subjected to empirical verification.

References

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